

Directing migration of human stem cells with electric fields

Grant Award Details

Directing migration of human stem cells with electric fields

Grant Type: Basic Biology I

Grant Number: RB1-01417

Project Objective: PI tested the hypothesis is that EFs are a powerful signal to direct migration of human embryonic stem cells (hESCs) and human nerve stem cells (hNSCs) through purinergic signaling.

Investigator:

Name: Min Zhao

Institution: University of California, Davis

Type: PI

Human Stem Cell Use: Embryonic Stem Cell

Award Value: \$816,228

Status: Closed

Progress Reports

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Reporting Period: NCE

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Grant Application Details

Application Title: Directing migration of human stem cells with electric fields

Public Abstract: Great progress has been made in the last decades to derive many types of human stem cells for potential therapeutic uses. However, practical clinical use is severely limited by several challenges. One of which is the poor homing and integration of transplanted cells with the targeted host tissues - only very few transplanted stem cells integrate structurally and functionally to the damaged or diseased tissues.

We recently demonstrated that at wounds and damaged tissue sites there are naturally occurring electric fields, which may send a signal to guide cell migration. Excitingly, applied EFs guide migration and division of murine embryonic stem cells (mESCs) and nerve stem cells (mNSCs). We hypothesize that EFs are an effective signal to direct migration of human embryonic stem cells (hESCs), and nerve stem cells (hNSCs) to, as well as engagement and interaction with, sites of tissue damage.

In this proposal, we will establish EFs as a novel signalling mechanisms to guide human stem cells homing and integration. We will optimize electric stimulations to direct migration of hESCs and hNSCs. We will combine the electric stimulation with other treatment to establish a potent and novel mechanism to direct the migration of beneficial human stem cells toward the injury sites to repair and to regenerate.

Statement of Benefit to California: This visionary endeavor of CIRM to develop stem cell therapies leads the nation and has been galvanizing stem cell researchers to California. This represents the leading role of California at the forefront of biomedical research. Joining this exciting program, we are poised to overcome one of the big hurdles in stem cell therapy - to guide stem cells to damaged and diseased tissues to repair and regenerate. Homing and integration of stem cells to the targeted tissues are critical steps in stem cell therapy. Many types of stem cell therapies have very poor results because of poor homing and integration of transplanted stem cells with the local damaged tissues.

Exploring signals to control cell migration and other behaviors, we have been developing a novel and potentially powerful signal – electric fields for better homing and integration. We propose to understand the electrical control of homing integration of stem cells. If successful, new techniques derived from this project will help to break one of the road locks in stem cell therapies. This grant proposal falls under the mission statement of the CIRM for funding innovative research to achieve effective stem cell therapies. We aim to generate innovative and effective techniques to guide migration of human stem cells. The concept and approach will benefit many types of stem cell therapies.

Techniques developed from this project are expected to significantly increase the efficiency of stem cell to integrate with the host tissues, therefore facilitate restoration of structure and function. If successful, this technique will lead to reduction in the medical and economic burden of large numbers of patients who need stem cell therapies, therefore contribute significantly to CIRM's mission.

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